正基科技股份有限公司

SPECIFICATION

PRODUCT NAME：AP6690P

REVISION：0.3(WEB)

DATE：June 25th , 2026

Customer APPROVED	
Company	
Representative Signature	

PREPARED	REVIEW			APPROVED	DCC ISSUE
	PM	QA	ET		

正基科技股份有限公司

AMPAK Technology Inc.

AP6690P

Data Sheet

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Revision

Revision	Date	Description	Revised By
0.1	2026/06/12	Preliminary Release	May
0.2	2026/06/15	Modify PIN OUT	May
0.3	2026/06/25	Modify BT Feature	May
0.4	2026/09/30	Modify RF Feature	May

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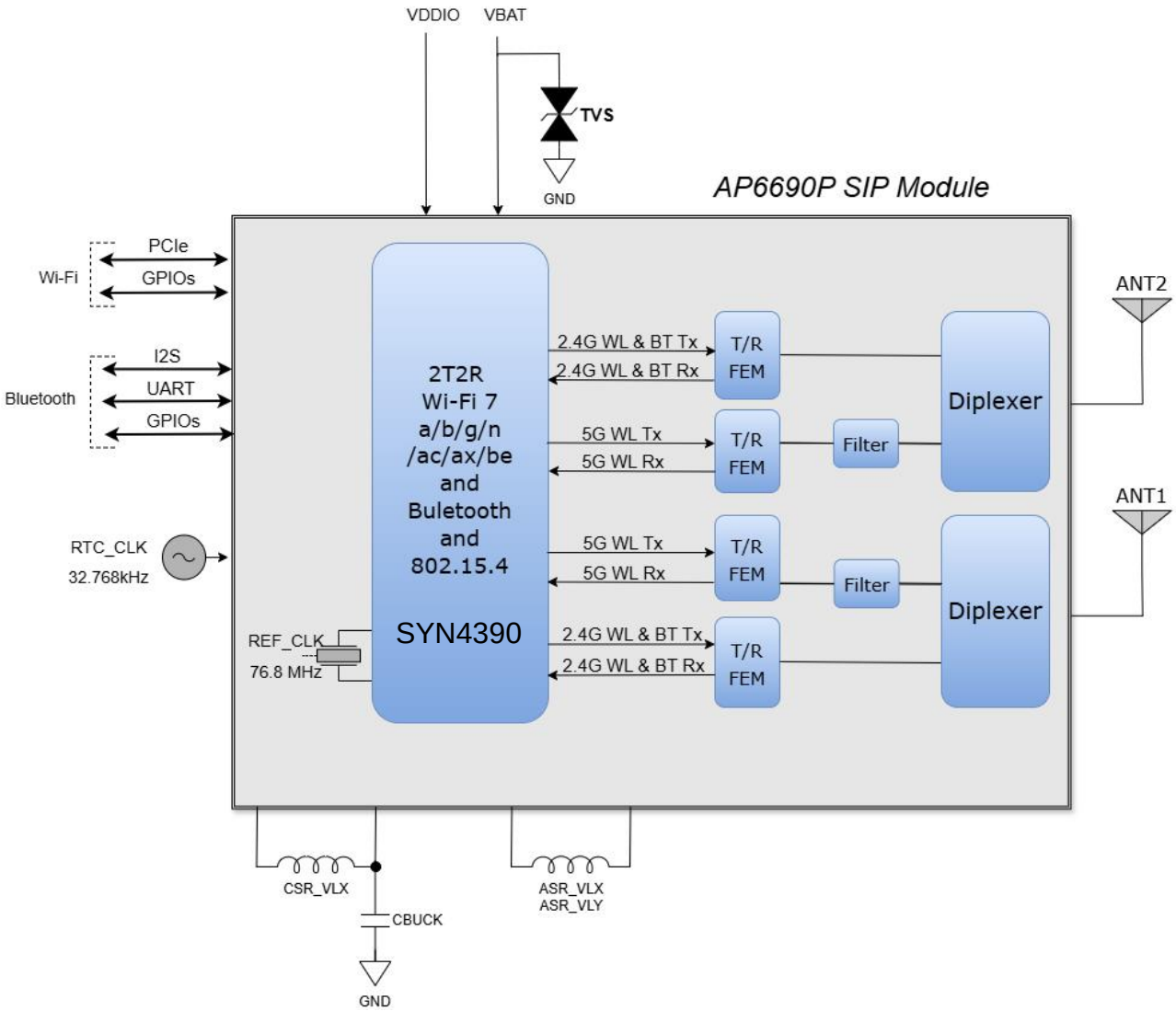
1. Introduction

1.1 Overview

The AMPAK Technology® AP6690P is a Wi-Fi 7(2.4/5/6GHz) and Bluetooth functionalities module with seamless roaming capabilities and advance security, also it could interact with different vendors' 802.11a/b/g/n/ac/ax/be 2x2 Access Points with MIMO standard and can accomplish up to speed of 2800Mbps with dual stream in 802.11be to connect the wireless LAN. Furthermore AP6690P included PCIE interface for Wi-Fi, UART/ I2S interface for Bluetooth.

In addition, this compact module is a total solution for a combination of Wi-Fi + Bluetooth technologies. The module is specifically developed for tablet, OTT box and portable devices.



1.2 Product Features

IEEE 802.11 Key Features

- IEEE Wi-Fi 7 compliant.
- Lead Free design which is compliant with ROHS requirements.
- TX and RX low-density parity check (LDPC) support for improved range and power efficiency.
- Dual-stream spatial multiplexing up to 2.8 Gbps data rate and 3Gpbs in RSDB mode.
- 20/40/80/160 MHz channels for 2X2 5GHz and 6GHz radio, and 20MHz channels for 2X2 2.4GHz radio.
- Client MU-MIMO
- Supports PCI express revision 3.0 and power management running at Gen3 speeds.
- Real-Simultaneous dual-band (RSDB) mode support.
- Supported Partial RU(Resource Unit) in 802.11ax/be.
- Supported Multi RU in 802.11be.
- Supported Preamble Puncturing in 802.11be(BW160MHz).
- Supported non-HT(802.11a) preamble in 6GHz.

Bluetooth Key Features

- Bluetooth host digital interface:
  - HCI UART (up to 4 Mbps)
  - I2S for audio data
- Complies with Bluetooth Core Specification Version 6.0 with provisions for supporting future specifications. With Bluetooth Class 1 or Class2 transmitter operation.
- Supports extended synchronous connections (eSCO), for enhanced voice quality by allowing for retransmission of dropped packets.
- Dual-core support.
- Supports High power mode.
- Bluetooth Core Specification Version 6.0, including the following support:
  - Low energy(LE) isochronous channels
  - LE power control
  - LE enhanced connection update
  - LE channel classification
  - LE audio

IEEE 802.15.4/Thread Key Feature

- Support IEEE 802.15.4/Thread that can act as Border Router.

2. General Specification

2.1 General Specification

Model Name	AP6690P
Product Description	2T2R 802.11 a/b/g/n/ac/ax/be Wi-Fi 7 + Bluetooth 6.0
Dimension	L x W : 17 x 17 (typical) mm，H : 2.5(max) mm
WiFi Interface	Support PCIe V3.0 compliant and runs at Gen3 speeds
Bluetooth Interface	Peripheral UART / I2S for audio data
Operating temperature	-30°C to 75°C (Note)
Storage temperature	-40°C to 105°C
Humidity	Operating Humidity 10% to 95% Non-Condensing Storage Humidity 5% to 95% Non-Condensing

Note: The optimal RF performance specified in the data sheet, however, is guaranteed only -10 °C to +55 °C and 3.3V < VBAT < 4.8V without derating performance.

2.2 DC Characteristics

2.2.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.5	5.25	V
VDDIO	Digital/Bluetooth/ I/O Voltage	-0.5	2.07	V

Extreme caution must be exercised to prevent electrostatic discharge (ESD) damage.

Symbol	Condition	ESD Rating	Unit
ESD_HAND_HBM	Human body model contact discharge per JEDEC EID/JESD22-A114	1.5	kV
ESD_HAND_CDM	Charged device model contact discharge per JEDEC EIA/JESD22-C101	250	V

2.2.2 Recommended Operating Rating

The module requires two power supplies: VBAT and VDDIO.

Voltage rails	Min.	Typ.	Max.	Unit
VBAT	3.0	3.85	5.0	V
VDDIO	1.62	1.8	1.98	V

VBAT current consumption 1200mA(Peak), when VBAT = 3.85

For 3.2V ≤ VBAT ≤ 4.8V, device radios will operate but RF performance will degrade.

The module requires two power supplies: other Digital I/O Pins.

For VDDIO=1.8V	Min.	Max.	Unit
VIH = Input high voltage	0.65 x VDDIO	NA	V
VIL = Input low voltage	NA	0.4 x VDDIO	V
VOH = Output high voltage @ 2mA	VDDIO – 0.4	NA	V
VOL = Output low voltage @ 2mA	NA	0.4	V

Programmable 2mA to 16mA drive strength. Default is 10mA.

3. Wi-Fi RF Specification(TBD)

3.1 2.4GHz RF Specification(TBD)

Conditions : VBAT=3.85V ; VDDIO=1.8V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11b/g/n/ac/ax/be & Wi-Fi compliant
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4GHz ISM Band)
Number of Channels	2.4GHz：Ch1 ~ Ch13
Modulation	802.11b : DQPSK、DBPSK、CCK 802.11 g/n : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ac/ax/be : OFDM(A) /1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK
Resource Unit	Partial RU : BW20MHz : 26T、52T、106T、242T Multi RU : BW20MHz : 52T+26T、106T+26T

Output Power , tolerance ± 1.5 dB

The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard

802.11b	**1Mbps**	**2Mbps**	**5.5Mbps**	**11Mbps**	
	18	18	18	18	
802.11g	**6、9Mbps**	**12、18Mbps**	**24Mbps**	**36Mbps**	**48Mbps**
	18	17.5	17.5	17	17
	54Mbps				
	17				
802.11n 20MHz	**MCS0~2**	**MCS3**	**MCS4**	**MCS5**	**MCS6**
	18	17.5	17.5	17	17
	MCS7				
	16				
802.11n 20MHz	**MCS0~2**	**MCS3**	**MCS4**	**MCS5**	**MCS6**
	18	17.5	17.5	17	17
	MCS7	**MCS7**			
	16	15			
802.11ax/be 20MHz	**HE0~2**	**HE3**	**HE4**	**HE5**	**HE6**
	18	17.5	17.5	17	17
	HE7	**HE8**	**HE9**	**HE10**	**HE11**

	16	15	14	14	14
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.					
Sensitivity, tolerance ± 2 dB **CCK modulation PER ≦ 8%、OFDM modulation PER ≦ 10%**					
802.11b	**Data Rate**	**Spec.(dBm)**			
	1Mbps	-95			
	2Mbps	-92			
	5.5Mbps	-89			
	11Mbps	-87			
802.11g	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**	
	6Mbps	-91	**24Mbps**	-83	
	9Mbps	-89	**36Mbps**	-80	
	12Mbps	-88	**48Mbps**	-75	
	18Mbps	-86	**54Mbps**	-74	
802.11n_20MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**	
	MCS0	-91	**MCS4**	-79	
	MCS1	-88	**MCS5**	-76	
	MCS2	-86	**MCS6**	-73	
	MCS3	-82	**MCS7**	-72	
802.11ac_20MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**	
	MCS0	-91	**MCS4**	-79	
	MCS1	-88	**MCS5**	-76	
	MCS2	-86	**MCS6**	-73	
	MCS3	-82	**MCS7**	-72	
			MCS8	-70	
802.11ax/be_20MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**	
	HE0	-91	**HE6**	-75	
	HE1	-90	**HE7**	-74	
	HE2	-87	**HE8**	-70	
	HE3	-85	**HE9**	-68	
	HE4	-81			
	HE5	-77			
Maximum Input Level	802.11b : -10 dBm				
	802.11g/n/ax : -20 dBm				

3.2 5GHz RF Specification(TBD)

Conditions : VBAT=3.85V ; VDDIO=1.8V ; Temp:25°C

Feature	Description
WLAN Standard	IEEE 802.11a/n/ac/ax/be & Wi-Fi compliant
Frequency Range	5.15~5.35GHz、5.47~5.725GHz、5.725~5.85GHz (5GHz UNII Band)
Number of Channels	5.15~5.35GHz：Ch36 ~ Ch64 5.47~5.725GHz：Ch100 ~ Ch144 5.725~5.85GHz：Ch149 ~ Ch165
Modulation	802.11a : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11n : OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ac : OFDM /256-QAM、OFDM /64-QAM、16-QAM、QPSK、BPSK 802.11ax/be : OFDM(A)/ 4096-QAM、1024-QAM、 OFDM /256-QAM、OFDM /64-QAM、16-QAM、QPSK、BPSK
Resource Unit	Partial RU : BW20MHz : 26T、52T、106T、242T BW40MHz : 26T、52T、106T、242T、484T BW80MHz : 26T、52T、106T、242T、484T、996T BW160MHz: 26T、52T、106T、242T、484T、996T、996T+996T Multi RU : BW20MHz : 52T+26T、106T+26T BW40MHz : 52T+26T、106T+26T BW80MHz : 52T+26T、106T+26T、484T+242T BW160MHz: 484T+242T、966T+484T、966T+484T+242T Preamble Puncturing pattern: 1、2、4、8 (484+242 80MHz) 3、12、48、192(966+484 160MHz) 1、2、4、8、16、32、64、128(966+484+242 160MHz)

Output Power , tolerance ± 2 dB

The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard

	Frequency (MHz)	6~9Mbps	12~18Mbps	24Mbps	36Mbps
802.11a	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5745~5845	15	15	15	15
	Frequency (MHz)	48Mbps	54Mbps		
	5150~5350	15	15		
	5470~5725	15	15		

	5745~5845	15	15		
802.11n 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	15	14		
	5470~5725	15	14		
	5725~5845	15	14		
802.11n 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	MCS6	MCS7		
	5150~5350	14	14		
	5470~5725	14	14		
	5725~5845	14	14		
802.11ac 20MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	MCS6	MCS7	MCS8	
	5150~5350	15	14	12	
	5470~5725	15	14	12	
	5725~5845	15	14	12	
802.11ac 40MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14	14	12	10
	5470~5725	14	14	12	10
	5725~5845	14	14	12	10
802.11ac 80MHz	Frequency (MHz)	MCS0~2	MCS3	MCS4	MCS5
	5150~5350	15	15	14.5	14.5
	5470~5725	15	15	14.5	14.5
	5725~5845	15	15	14.5	14.5

	Frequency (MHz)	MCS6	MCS7	MCS8	MCS9
	5150~5350	14	14	10	10
	5470~5725	14	14	10	10
	5725~5845	14	14	10	10
802.11ax 20MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14.5	14.5	12	12
	5470~5725	14.5	14.5	12	12
	5725~5845	14.5	14.5	12	12
	Frequency (MHz)	HE10	HE11		
	5150~5350	10	10		
	5470~5725	10	10		
	5725~5845	10	10		
802.11ax 40MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14.5	14.5	12	10
	5470~5725	14.5	14.5	12	10
	5725~5845	14.5	14.5	12	10
	Frequency (MHz)	HE10	HE11		
	5150~5350	8	8		
	5470~5725	8	8		
	5725~5845	8	8		
802.11ax 80MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	15	15	14.5	14.5
	5470~5725	15	15	14.5	14.5
	5725~5845	15	15	14.5	14.5
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	14	14	10	10
	5470~5725	14	14	10	10
	5725~5845	14	14	10	10
	Frequency (MHz)	HE10	HE11		

	5150~5350	8	8		
	5470~5725	8	8		
	5725~5845	8	8		
802.11ax 160MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5150~5350	15	15	14	14
	5470~5725	15	15	14	14
	5725~5845	15	15	14	14
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5150~5350	13	13	10	10
	5470~5725	13	13	10	10
	5725~5845	13	13	10	10
	Frequency (MHz)	HE10	HE11		
	5150~5350	7	6.5		
	5470~5725	7	6.5		
	5725~5845	7	6.5		
802.11be 20MHz	Frequency (MHz)	EHT0~2	EHT3	EHT4	EHT5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	EHT6	EHT7	EHT8	EHT9
	5150~5350	14.5	14.5	12	12
	5470~5725	14.5	14.5	12	12
	5725~5845	14.5	14.5	12	12
	Frequency (MHz)	EHT0	EHT11	EHT12	EHT13
	5150~5350	10	10	9	8
	5470~5725	10	10	9	8
	5725~5845	10	10	9	8
802.11be 40MHz	Frequency (MHz)	EHT0~2	EHT3	EHT4	EHT5
	5150~5350	15	15	15	15
	5470~5725	15	15	15	15
	5725~5845	15	15	15	15
	Frequency (MHz)	EHT6	EHT7	EHT8	EHT9
	5150~5350	14.5	14.5	12	10
	5470~5725	14.5	14.5	12	10
	5725~5845	14.5	14.5	12	10
	Frequency (MHz)	EHT0	EHT11	EHT12	EHT13
	5150~5350	8	8	7	6

	5470~5725	8	8	7	6
	5725~5845	8	8	7	6
802.11be 80MHz	Frequency (MHz)	EHT0~2	EHT3	EHT4	EHT5
	5150~5350	15	15	14.5	14.5
	5470~5725	15	15	14.5	14.5
	5725~5845	15	15	14.5	14.5
	Frequency (MHz)	EHT6	EHT7	EHT8	EHT9
	5150~5350	14	14	10	10
	5470~5725	14	14	10	10
	5725~5845	14	14	10	10
	Frequency (MHz)	EHT0	EHT11	EHT12	EHT13
	5150~5350	8	8	7	6
	5470~5725	8	8	7	6
	5725~5845	8	8	7	6
802.11be 160MHz	Frequency (MHz)	EHT0~2	EHT3	EHT4	EHT5
	5150~5350	15	15	14.5	14.5
	5470~5725	15	15	14.5	14.5
	5725~5845	15	15	14.5	14.5
	Frequency (MHz)	EHT6	EHT7	EHT8	EHT9
	5150~5350	14	14	10	10
	5470~5725	14	14	10	10
	5725~5845	14	14	10	10
	Frequency (MHz)	EHT0	EHT11	EHT12	EHT13
	5150~5350	7	7	6	5
	5470~5725	7	7	6	5
	5725~5845	7	7	6	5
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.					

Sensitivity, tolerance ± 2 dB , OFDM modulation PER ≦ 10%				
802.11a	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	6Mbps	-91	24Mbps	-83
	9Mbps	-89	36Mbps	-79
	12Mbps	-88	48Mbps	-75
	18Mbps	-86	54Mbps	-74
802.11n_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS4	-79
	MCS1	-88	MCS5	-75

	MCS2	-86	MCS6	-73
	MCS3	-82	MCS7	-72
802.11n_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS4	-76
	MCS1	-85	MCS5	-72
	MCS2	-83	MCS6	-71
	MCS3	-80	MCS7	-69
802.11ac_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-91	MCS5	-75
	MCS1	-88	MCS6	-73
	MCS2	-85	MCS7	-72
	MCS3	-82	MCS8	-68
	MCS4	-79		
802.11ac_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-88	MCS5	-72
	MCS1	-85	MCS6	-71
	MCS2	-83	MCS7	-69
	MCS3	-80	MCS8	-65
	MCS4	-76	MCS9	-63
802.11ac_80MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	MCS0	-85	MCS5	-69
	MCS1	-82	MCS6	-67
	MCS2	-79	MCS7	-66
	MCS3	-76	MCS8	-62
	MCS4	-73	MCS9	-60
802.11ax_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-91	HE6	-75
	HE1	-90	HE7	-73
	HE2	-87	HE8	-70
	HE3	-84	HE9	-68
	HE4	-81	HE10	-64
	HE5	-76	HE11	-62
802.11ax_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-89	HE6	-72
	HE1	-87	HE7	-70
	HE2	-84	HE8	-67
	HE3	-82	HE9	-65

	HE4	-78	HE10	-62
	HE5	-74	HE11	-59
802.11ax_80MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-85	HE6	-68
	HE1	-84	HE7	-67
	HE2	-81	HE8	-63
	HE3	-78	HE9	-61
	HE4	-74	HE10	-58
	HE5	-70	HE11	-55
802.11ax_160MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-85	HE6	-68
	HE1	-84	HE7	-67
	HE2	-81	HE8	-63
	HE3	-78	HE9	-61
	HE4	-74	HE10	-58
	HE5	-70	HE11	-55
802.11be_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-91	HE6	-75
	HE1	-90	HE7	-73
	HE2	-87	HE8	-70
	HE3	-84	HE9	-68
	HE4	-81	HE10	-64
	HE5	-76	HE11	-62
	HE12		HE13	
802.11be_40MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-89	HE6	-72
	HE1	-87	HE7	-70
	HE2	-84	HE8	-67
	HE3	-82	HE9	-65
	HE4	-78	HE10	-62
	HE5	-74	HE11	-59
	HE12		HE13	
802.11be_80MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-85	HE6	-68
	HE1	-84	HE7	-67
	HE2	-81	HE8	-63
	HE3	-78	HE9	-61

	HE4	-74	**HE10**	-58
	HE5	-70	**HE11**	-55
	HE12		**HE13**	
802.11be_160MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
	HE0	-85	**HE6**	-68
	HE1	-84	**HE7**	-67
	HE2	-81	**HE8**	-63
	HE3	-78	**HE9**	-61
	HE4	-74	**HE10**	-58
	HE5	-70	**HE11**	-55
	HE12		**HE13**	
Maximum Input Level	802.11a/n/ac/ax/be : -30 dBm			

3.3 6GHz RF Specification(TBD)

Conditions : VBAT=3.85V ; VDDIO=1.8V ; Temp:25°C

Feature	**Description**
WLAN Standard	IEEE 802.11ax/be Non-HT(802.11a) preamble for ack/beacon
Frequency Range	5.925 ~ 7.125GHz
Number of Channels	5955~5415MHz：6G1 ~ 6G93、6435~6515MHz：6G97 ~ 6G113 6535~6855MHz：6G117 ~ 6G181、6875~7115MHz：6G185 ~ 6G233
Modulation	802.11ax/be : OFDM(A) /4096-QAM、1024-QAM、256-QAM、64-QAM、16-QAM、QPSK、BPSK
Resource Unit	Partial RU : BW20MHz : 26T、52T、106T、242T BW40MHz : 26T、52T、106T、242T、484T BW80MHz : 26T、52T、106T、242T、484T、996T BW160MHz: 26T、52T、106T、242T、484T、996T、996T+996T Multi RU : BW20MHz : 52T+26T、106T+26T BW40MHz : 52T+26T、106T+26T BW80MHz : 52T+26T、106T+26T、484T+242T BW160MHz: 484T+242T、966T+484T、966T+484T+242T Preamble Puncturing pattern:

	1、2、4、8 (484+242 80MHz) 3、12、48、192(966+484 160MHz) 1、2、4、8、16、32、64、128(966+484+242 160MHz)

Output Power(dBm) , tolerance ± 2 dB

The transmit EVM quality & spectrum mask are compliant with IEEE 802.11 standard

802.11ax 20MHz	**Frequency (MHz)**	**HE0~2**	**HE3**	**HE4**	**HE5**
	5955~5415	14	14	13.5	13.5
	6435~6515	14	14	13.5	13.5
	6535~6855	14	14	13.5	13.5
	6875~7115	12	12	12	12
	Frequency (MHz)	**HE6**	**HE7**	**HE8**	**HE9**
	5955~5415	13.5	12.5	10.5	10.5
	6435~6515	13.5	12.5	10.5	10.5
	6535~6855	13.5	12.5	10.5	10.5
	6875~7115	12	12	10.5	10.5
	Frequency (MHz)	**HE10**	**HE11**		
	5955~5415	9.5	9.5		
	6435~6515	9.5	9.5		
	6535~6855	9.5	9.5		
	6875~7115	9.5	9.5		
802.11ax 40MHz	**Frequency (MHz)**	**HE0~2**	**HE3**	**HE4**	**HE5**
	5955~5415	14	14	13	13
	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	12	12	12	12
	Frequency (MHz)	**HE6**	**HE7**	**HE8**	**HE9**
	5955~5415	12.5	12.5	11	9
	6435~6515	12.5	12.5	11	9
	6535~6855	12.5	12.5	11	9
	6875~7115	12	12	11	9
	Frequency (MHz)	**HE10**	**HE11**		
	5955~5415	8	8		
	6435~6515	8	8		
	6535~6855	8	8		
	6875~7115	8	8		
802.11ax 80MHz	**Frequency (MHz)**	**HE0~2**	**HE3**	**HE4**	**HE5**
	5955~5415	14	14	13	13

	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	12	12	12	12
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5955~5415	12.5	12.5	10	9
	6435~6515	12.5	12.5	10	9
	6535~6855	12.5	12.5	10	9
	6875~7115	12	12	10	9
	Frequency (MHz)	HE10	HE11		
	5955~5415	8	8		
	6435~6515	8	8		
	6535~6855	8	8		
	6875~7115	8	8		
802.11ax 160MHz	Frequency (MHz)	HE0~2	HE3	HE4	HE5
	5955~5415	14	14	13	13
	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	12	12	12	12
	Frequency (MHz)	HE6	HE7	HE8	HE9
	5955~5415	12.5	12.5	10	9
	6435~6515	12.5	12.5	10	9
	6535~6855	12.5	12.5	10	9
	6875~7115	12	12	10	9
	Frequency (MHz)	HE10	HE11		
	5955~5415	8	8		
	6435~6515	8	8		
	6535~6855	8	8		
	6875~7115	8	8		
802.11be 20MHz	Frequency (MHz)	EHT0~2	EHT 3	EHT 4	EHT 5
	5955~5415	14	14	13.5	13.5
	6435~6515	14	14	13.5	13.5
	6535~6855	14	14	13.5	13.5
	6875~7115	14	14	13.5	13.5
	Frequency (MHz)	EHT 6	EHT 7	EHT 8	EHT 9
	5955~5415	13.5	12.5	10.5	10.5
	6435~6515	13.5	12.5	10.5	10.5
	6535~6855	13.5	12.5	10.5	10.5

	6875~7115	13.5	12.5	10.5	10.5
	Frequency (MHz)	EHT 10	EHT 11	EHT12	EHT13
	5955~5415	8.5	8.5	7.5	7.5
	6435~6515	8.5	8.5	7.5	7.5
	6535~6855	8.5	8.5	7.5	7.5
	6875~7115	8.5	8.5	7.5	7.5
802.11be 40MHz	Frequency (MHz)	EHT0~2	EHT 3	EHT 4	EHT 5
	5955~5415	14	14	13	13
	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	14	14	13	13
	Frequency (MHz)	EHT 6	EHT 7	EHT 8	EHT 9
	5955~5415	13.5	12.5	10.5	10.5
	6435~6515	13.5	12.5	10.5	10.5
	6535~6855	13.5	12.5	10.5	10.5
	6875~7115	13.5	12.5	10.5	10.5
	Frequency (MHz)	EHT 10	EHT 11	EHT12	EHT13
	5955~5415	8.5	8.5	7.5	7.5
	6435~6515	8.5	8.5	7.5	7.5
	6535~6855	8.5	8.5	7.5	7.5
	6875~7115	8.5	8.5	7.5	7.5
802.11be 80MHz	Frequency (MHz)	EHT0~2	EHT 3	EHT 4	EHT 5
	5955~5415	14	14	13	13
	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	14	14	13	13
	Frequency (MHz)	EHT 6	EHT 7	EHT 8	EHT 9
	5955~5415	13.5	12.5	10.5	10.5
	6435~6515	13.5	12.5	10.5	10.5
	6535~6855	13.5	12.5	10.5	10.5
	6875~7115	13.5	12.5	10.5	10.5
	Frequency (MHz)	EHT 10	EHT 11	EHT12	EHT13
	5955~5415	8	8	7	6.5
	6435~6515	8	8	7	6.5
	6535~6855	8	8	7	6.5
	6875~7115	8	8	7	6.5
	Frequency (MHz)	EHT0~2	EHT 3	EHT 4	EHT 5

802.11be 160MHz	5955~5415	14	14	13	13
	6435~6515	14	14	13	13
	6535~6855	14	14	13	13
	6875~7115	14	14	13	13
	Frequency (MHz)	**EHT 6**	**EHT 7**	**EHT 8**	**EHT 9**
	5955~5415	13.5	12.5	10.5	10
	6435~6515	13.5	12.5	10.5	10
	6535~6855	13.5	12.5	10.5	10
	6875~7115	13.5	12.5	10.5	10
	Frequency (MHz)	**EHT 10**	**EHT 11**	**EHT12**	**EHT13**
	5955~5415	7	7	6	5.5
	6435~6515	7	7	6	5.5
	6535~6855	7	7	6	5.5
	6875~7115	7	7	6	5.5
Note: The specifications of RF output power are subject to change to fulfill the safety regulation and requirements in end-user product.					

Sensitivity, tolerance ± 2 dB, OFDM modulation PER ≦ 10%				
802.11ax_20MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
	HE0	-86	**HE6**	-70
	HE1	-84	**HE7**	-68
	HE2	-81	**HE8**	-64
	HE3	-79	**HE9**	-62
	HE4	-75	**HE10**	-59
	HE5	-72	**HE11**	-56
802.11ax_40MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
	HE0	-85	**HE6**	-68
	HE1	-83	**HE7**	-67
	HE2	-80	**HE8**	-63
	HE3	-77	**HE9**	-61
	HE4	-74	**HE10**	-58
	HE5	-70	**HE11**	-55
802.11ax_80MHz	**Data Rate**	**Spec.(dBm)**	**Data Rate**	**Spec.(dBm)**
	HE0	-82	**HE6**	-65
	HE1	-80	**HE7**	-64
	HE2	-77	**HE8**	-60

	HE3	-75	HE9	-58
	HE4	-71	HE10	-55
	HE5	-67	HE11	-53
802.11ax_160MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	HE0	-82	HE6	-65
	HE1	-80	HE7	-64
	HE2	-77	HE8	-60
	HE3	-75	HE9	-58
	HE4	-71	HE10	-55
	HE5	-67	HE11	-53
802.11be_20MHz	Data Rate	Spec.(dBm)	Data Rate	Spec.(dBm)
	EHT0	-86	EHT 7	-68
	EHT 1	-84	EHT 8	-64
	EHT 2	-81	EHT 9	-62
	EHT 3	-79	EHT 10	-59
	EHT4	-75	EHT 11	-56
	EHT 5	-72	EHT 12	-56
	EHT6		EHT13	
802.11be_40MHz	EHT0	-85	EHT 7	-67
	EHT 1	-83	EHT 8	-63
	EHT 2	-80	EHT 9	-61
	EHT 3	-77	EHT 10	-58
	EHT4	-74	EHT 11	-55
	EHT 5	-70	EHT 12	
	EHT6	-68	EHT13	
802.11be_80MHz	EHT0	-82	EHT 7	-64
	EHT 1	-80	EHT 8	-60
	EHT 2	-77	EHT 9	-58
	EHT 3	-75	EHT 10	-55
	EHT4	-71	EHT 11	-53
	EHT 5	-67	EHT 12	
	EHT6	-65	EHT13	
802.11be_160MHz	EHT0	-82	EHT 7	-64
	EHT 1	-80	EHT 8	-60
	EHT 2	-77	EHT 9	-58
	EHT 3	-75	EHT 10	-55
	EHT4	-71	EHT 11	-53

	EHT 5	-67	**EHT 12**	
	EHT6	-65	**EHT13**	
Maximum Input Level	802.11ax/be : -30dBm			

4. Bluetooth Specification(TBD)

Conditions : VBAT=3.85V ; VDDIO=1.8V ; Temp:25°C

Feature	**Description**	
General Specification		
Bluetooth Standard	BDR、EDR(2Mbps & 3Mbps)、LE(1/2Mbps)、LELR(128/512Kbps)	
Host Interface	UART	
Frequency Band	2402 MHz ~ 2480 MHz	
Number of Channels	79 channels for classic、40 channels for BLE	
Modulation	GFSK, π/4-DQPSK, 8DPSK	
RF Specification		
Output Power , tolerance ± 2 dB		
	Middle Power (dBm)	**High Power**(dBm)
BDR Output Power	6	17
EDR Output Power	6	14
BLE Output Power	6	17
Sensitivity, tolerance ± 2 dB		
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-88 dBm	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)	-91 dBm	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-85 dBm	
Sensitivity @ PER=30.8% for LE (1Mbps)	-90 dBm	
Sensitivity @ PER=30.8% for 2LE (2Mbps)	-91dBm	
Sensitivity @ PER=30.8% for LELR (125Kbps)	-102 dBm	
Sensitivity @ PER=30.8% for LELR (500Kbps)	-96 dBm	
Maximum Input Level	GFSK (1Mbps):-20dBm	
	π/4-DQPSK (2Mbps) :-20dBm	

	8DPSK (3Mbps) :-20dBm

Note*：The Bluetooth BDR output power is able to be configured by firmware (hcd file).

5. IEEE 802.15.4 Specification(TBD)

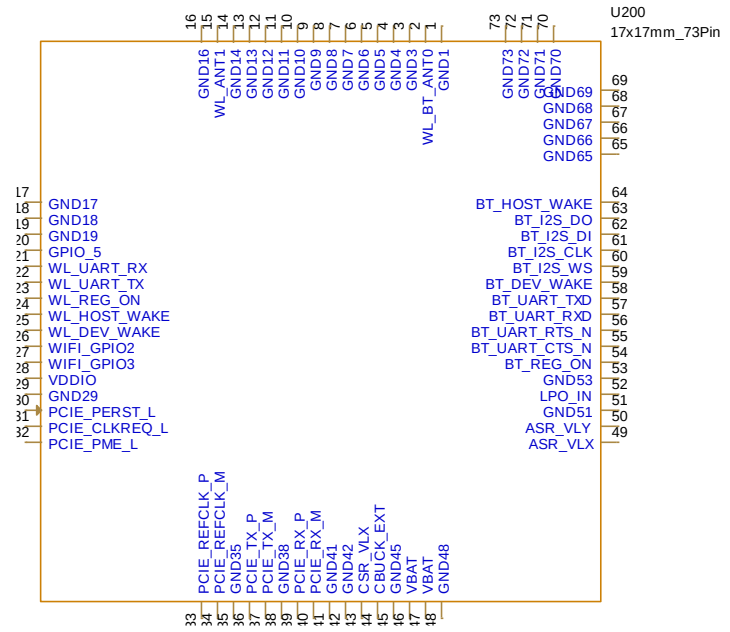
Conditions : VBAT=3.85V ; VDDIO=1.8V ; Temp:25°C

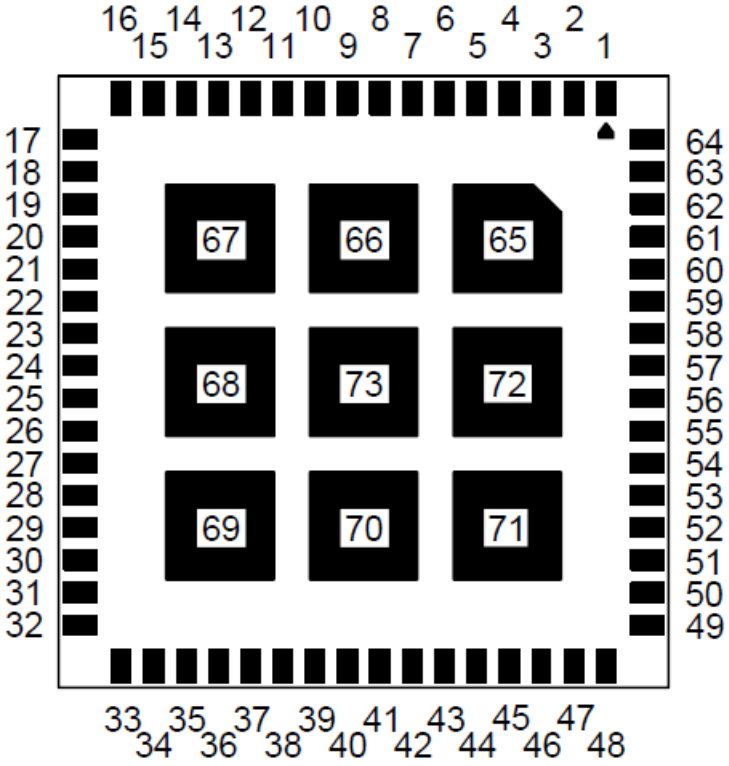
Feature	**Description**
General Specification	
Zigbee Standard	IEEE 802.15.4
Host Interface	UART
Frequency Band	2405 MHz ~ 2480 MHz
Number of Channels	16 channels(channel 11~channel 26)
Channel list	2405(ch11)、2410(ch12)…、2480(ch26)
Modulation	OQPSK(250kbps)
RF Specification	
Output Power , tolerance ± 2 dB	
	dBm
OQPSK Output Power*	10
Sensitivity, tolerance ± 2 dB	
Sensitivity @ PER=1% for 250kbps OQPSK	-101 dBm

Note*：The output power is able to be configured by firmware (hcd file).

6. Pin Definition

6.1 Pin Outline





<Top View>

6.2 Pin Assignment

NO	Name	Type	Description
1	GND	–	Ground Connections
2	2G/5G_C0_ANT	I/O	2.4 GHz (WLAN, Bluetooth®, and scan) shared RF I/O, core 0 , 5 GHz/6 GHz (WLAN and scan) shared RF I/O, core 0
3	GND	–	Ground Connections
4	GND	–	Ground Connections
5	GND	–	Ground Connections
6	GND	–	Ground Connections
7	GND	–	Ground Connections
8	GND	–	Ground Connections
9	GND	–	Ground Connections
10	GND	–	Ground Connections
11	GND	–	Ground Connections
12	GND	–	Ground Connections
13	GND	–	Ground Connections
14	GND	–	Ground Connections
15	2G/5G_C1_ANT	I/O	2.4 GHz (WLAN and Bluetooth®) shared RF I/O, core 1 5 GHz/6 GHz WLAN RF I/O, core 1
16	GND	–	Ground Connections
17	GND	–	Ground Connections
18	GND	–	Ground Connections
19	GND	–	Ground Connections
20	GPIO_5	–	Programmable GPIO_5 pin
21	WL_DBG_UART_RX	I/O	Programmable GPIO_10 pin UART Serial data input for the WLAN debug.
22	WL_DBG_UART_TX	I/O	Programmable GPIO_11 pin UART Serial data output for the WLAN debug.
23	WL_REG_ON	I	When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low, the WLAN section is in reset. If BT_REG_ON and WL_REG_ON are both low, the regulators are disabled. This pin has an internal 100k ohm pull-down resistor that is auto enabled and disabled when the input is low and

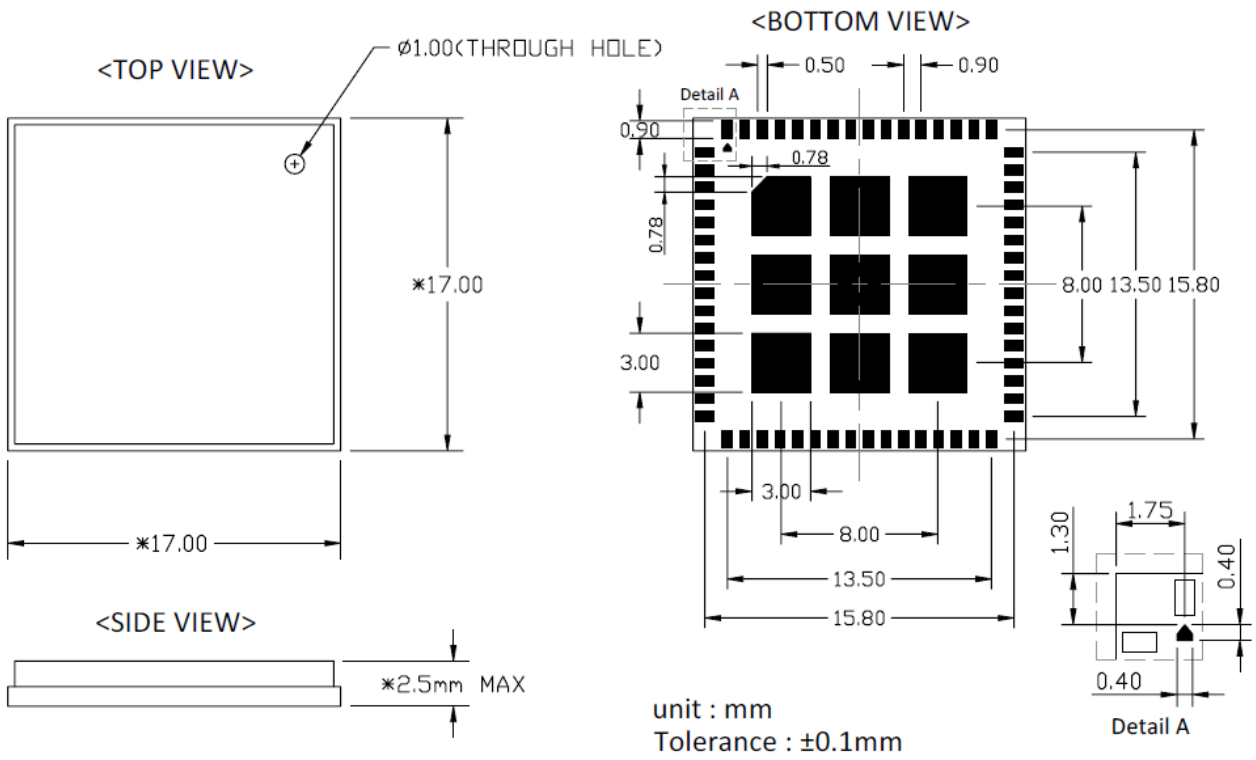
			high, respectively.
24	WL_HOST_WAKE	I/O	Programmable GPIO_0 pin WLAN host wake
25	WL_DEV_WAKE	I/O	Programmable GPIO_1 pin WLAN device wake
26	GPIO_2	I/O	Programmable GPIO_2 pin
27	GPIO_3	I/O	Programmable GPIO_3 pin
28	VDDIO	P	1.8V input supply for the WL/BT_REG_ON pin and others WL & BT I/O pin detection block and the oscillator supplied by the system platform
29	GND	–	Ground Connections
30	PCIE_PERST_L	I (PU)	PCIe system reset. This input is the PCIe reset as defined in the PCIe base specification version1.1. PERST_L is supplied by VDDIO_LV, which can be 1.8V.
31	PCIE_CLKREQ_L	OD	PCIe clock request signal which indicates when the REFCLK to the PCIe interface can be gated. 1 = the clock can be gated. 0 = the clock is required. PCIE_CLKREQ_L is supplied by VDDIO_LV, which can be 1.8V.
32	PCIE_PME_L	OD	PCI power management event output. Used to request a change in the device or system power state. The assertion and de-assertion of this signal are asynchronous to the PCIe reference clock. This signal has an open-drain output structure, as per the PCI Bus Local Bus Specification, revision 2.3.
33	PCIE_REFCLK_P	I	WLAN PCI Express® interface PCIe differential clock inputs (Positive). 100MHz differential.
34	PCIE_REFCLK_M	I	WLAN PCI Express® interface PCIe differential clock inputs (Negative). 100MHz differential.
35	GND	–	Ground Connections
36	PCIE_TX_P	O	WLAN PCI Express® interface Transmitter differential pair (×1 lane)_Positive
37	PCIE_TX_M	O	WLAN PCI Express® interface Transmitter differential pair (×1 lane)_Negative

38	GND	–	Ground Connections
39	PCIE_RX_P	I	WLAN PCI Express® interface Receiver differential pair (×1 lane)_Positive
40	PCIE_RX_M	I	WLAN PCI Express® interface Receiver differential pair (×1 lane)_Negative
41	GND	–	Ground Connections
42	GND	–	Ground Connections
43	CSR_VLX	O	CBUCK output to power inductor
44	CBUCK_EXT	I	Input FB for the CSR of CBUCK output power inductor
45	GND	–	Ground Connections
46	VBAT	P	DC input power supply voltage for VBAT
47	VBAT	P	DC input power supply voltage for VBAT
48	GND	–	Ground Connections
49	ASR_VLX	O	ABUCK output to inductor
50	ASR_VLY	O	Input to ABUCK output power mux
51	GND	–	Ground Connections
52	LPO_IN	I	External sleep clock input (32.768kHz)
53	GND	–	Ground Connections
54	BT_REG_ON	I	When a PCIe host is shared between the WLAN and BT subsystems, BT_REG_ON is not used and must be driven low or left floating.
55	BT_UART_CTS_N	I	Bluetooth® UART UART clear-to-send. Active low clear-to-send signal for the HCI UART interface.
56	BT_UART_RTS_N	O	Bluetooth® UART UART request-to-send. Active low request-to-send signal for the HCI UART interface. BT LED control pin.
57	BT_UART_RXD	I	Bluetooth® UART UART serial input. Serial data input for the HCI UART interface.
58	BT_UART_TXD	O	Bluetooth® UART

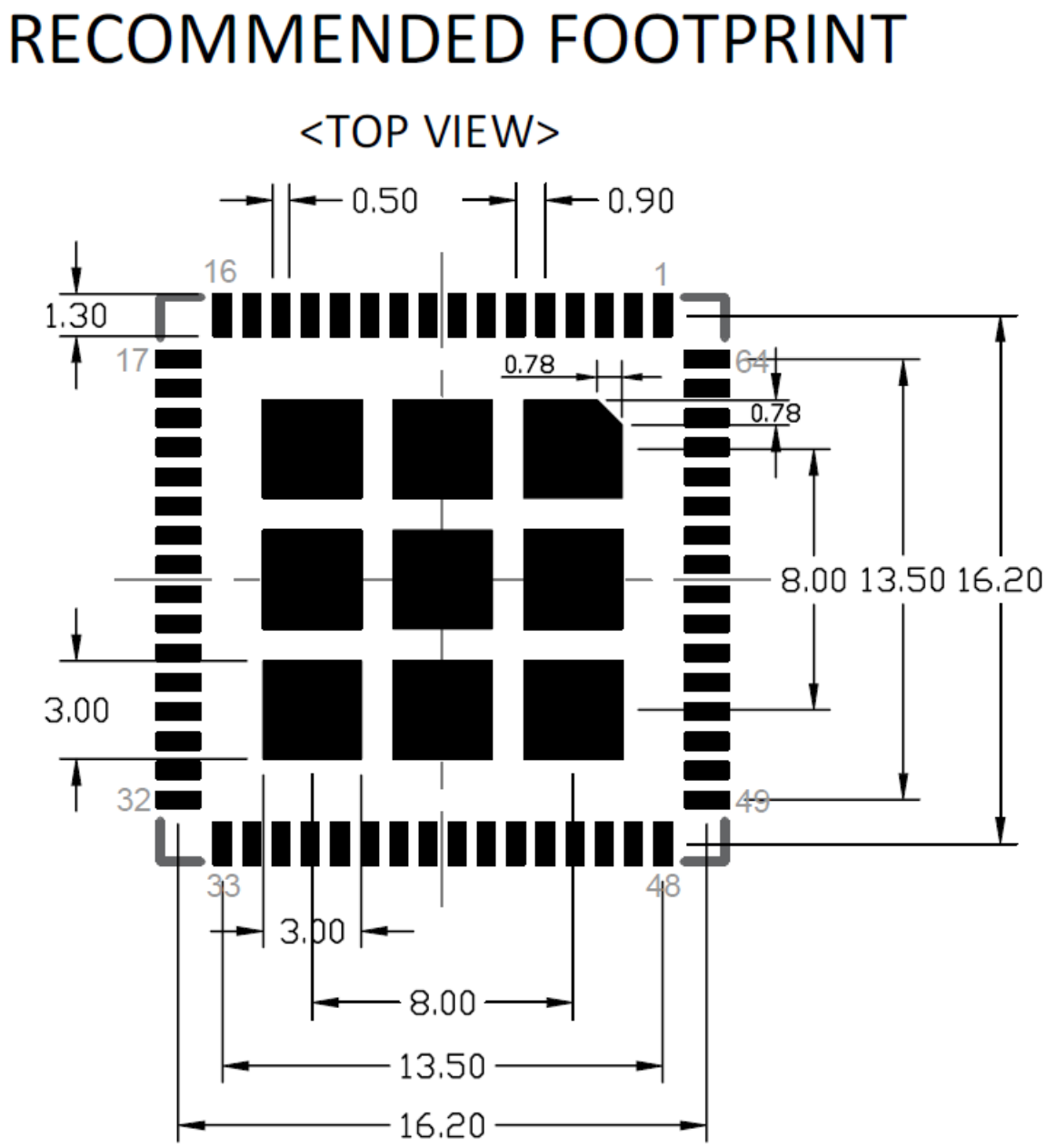
			UART serial output. Serial data output for the HCI UART interface.
59	BT_DEV_WAKE	I/O	Bluetooth® device wake
60	BT_I2S_WS	I/O	Bluetooth® I2S I2S Word Select (WS); can be an output (master) or an input (non master)
61	BT_I2S_CLK	I/O	Bluetooth® I2S I2S Clock; can be an output (master) or an input (non master)
62	BT_I2S_DI	I/O	Bluetooth® I2S I2S data input
63	BT_I2S_DO	I/O	Bluetooth® I2S I2S data output
64	BT_HOST_WAKE	I/O	Bluetooth® host wake
65	GND	–	Ground Connections
66	GND	–	Ground Connections
67	GND	–	Ground Connections
68	GND	–	Ground Connections
69	GND	–	Ground Connections
70	GND	–	Ground Connections
71	GND	–	Ground Connections
72	GND	–	Ground Connections
73	GND	–	Ground Connections

7. Dimensions

7.1 Module Physical Dimensions



7.2 Recommended footprint



- Solder paste layer design is generally the same as recommended footprint.
- If soldering quality with good wetting on upright side is essential for PQC, how to optimize the aperture design in the stencil to adjust the amount of solder paste would be crucial.
  In addition, a kind of stencil design with stepped thickness in partial area would be considered if the thickness of stencil is about 0.1mm or thinner. Please optimize the stencil design by manufacture engineer or contact AMPAK FAE for assistance.

8. External clock reference

External 32.768 kHz Low-Power Oscillator

The AP6690P uses a secondary low-frequency clock for low-power mode timing. Either the internal low precision LPO or an external 32.768 kHz precision oscillator is required. The internal LPO frequency range is approximately 33 kHz (± 30%) over process, voltage, and temperature, which is adequate for some applications. However, one trade-off caused by this wide LPO tolerance is a small current consumption increase during power-save mode that is incurred by the need to wake up earlier to avoid missing beacons.

Whenever possible, the preferred approach is to use a precision external 32.768 kHz clock which meets the requirements listed in the following table.

External LPO signal characteristics

Parameter	Specification	Units
Nominal input frequency	32.768	kHz
Frequency accuracy	+/-25	ppm
Duty cycle	30 - 70	%
Input signal amplitude	1.8±0.09	V
Signal type	Square-wave or sine-wave	-
Input impedance	>100k <5	Ω pF
Clock jitter (integrated over 300Hz – 15KHz)	<1	Hz
Output high voltage	0.7Vio - Vio	V

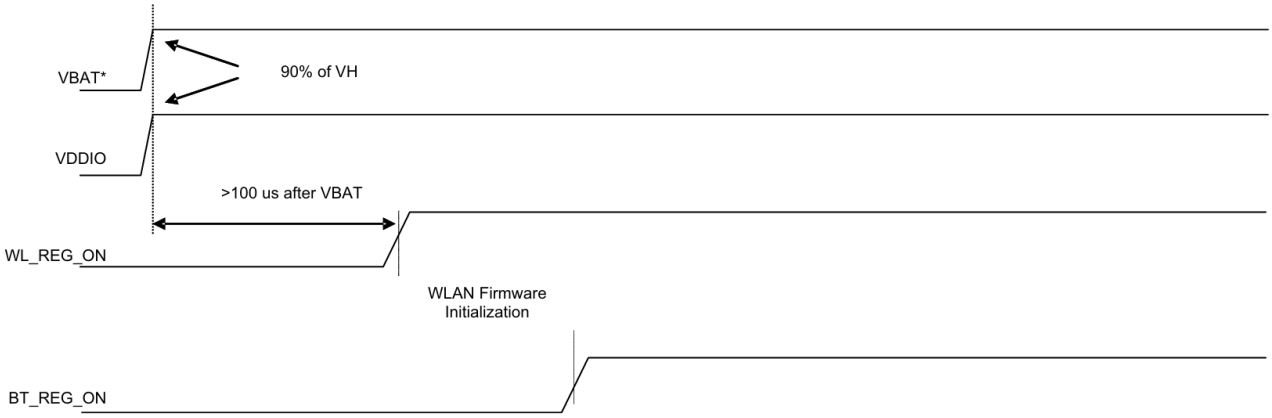
9. Host Interface Timing Diagram

9.1 Reset and Regulator Control Signals Sequencing

The module has signals that allow the host to control power consumption by enabling or disabling the Bluetooth, WLAN and internal regulator blocks. These signals are described below.
Additionally, diagrams are provided to indicate proper sequencing of the signals for carious operating states. The timing value indicated are minimum required values: longer delays are also acceptable.

- WL_REG_ON: This signal is used by the PMU to power up the WLAN section. It is also OR-gated with the BT_REG_ON input to control the internal regulators. When this pin is high, the regulators are enabled and the WLAN section is out of reset. When this pin is low, the WLAN section is in reset. If BT_REG_ON and WL_REG_ON are both low, the regulators are disabled.
- BT_REG_ON: This signal is used by the PMU to decide whether or not to power down the internal regulators. If BT_REG_ON and WL_REG_ON are low, the regulators will be disabled.
- It suggests customers connect WL_REG_ON and BT_REG_ON to GPIOs for control, otherwise unexpected errors may occur when boot-up the device.
- In the figure, The VDDIO power supply has been included in the module. When VBAT is power-up, VDDIO will rise to high level after 15 ms.
- The module main chip has an internal power-on reset (POR) circuit. The device will be held in reset for a maximum of 110 ms after VDDC and VDDIO have both passed the POR threshold. Wait at least 150 ms after VDDC and VDDIO are available before initiating PCIe accesses.

Note: The VBAT and VDDIO 10%–90% rise-times slopes must be greater than 50 µs/V.

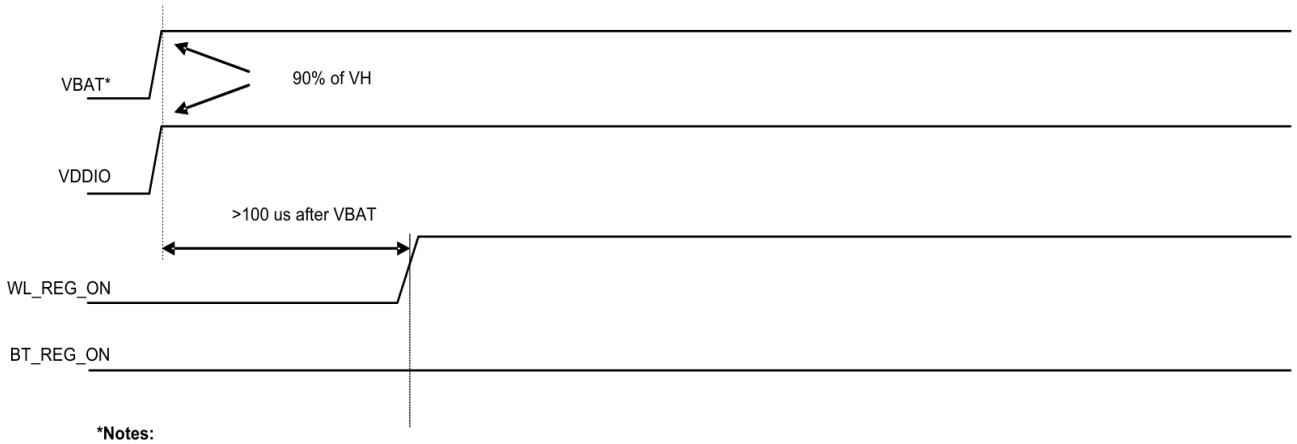


***Notes:**
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 µs/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

WLAN Is ON, Bluetooth Is ON

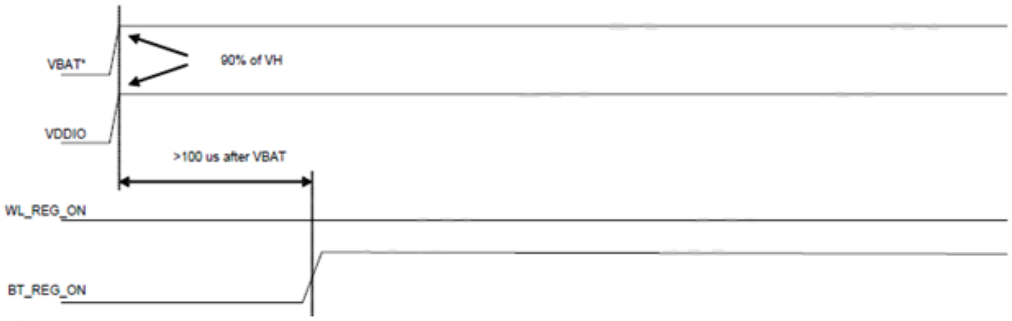
***Notes:**
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 µs/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

WLAN Is OFF, Bluetooth IsOFF



***Notes:**
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 µs/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

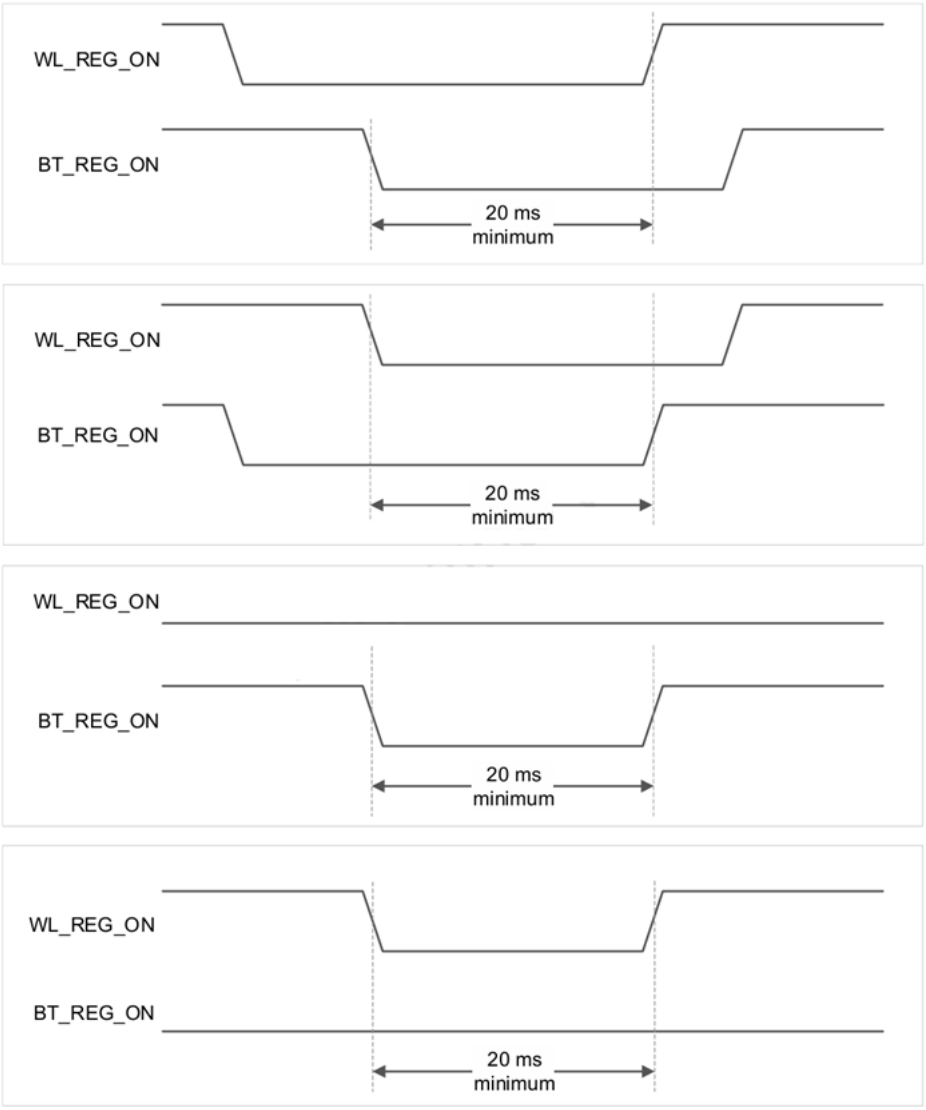
WLAN Is ON, Bluetooth Is OFF



***Notes:**
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 µs/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should NOT be present first or be held high before VBAT is high.

WLAN Is OFF, Bluetooth Is ON

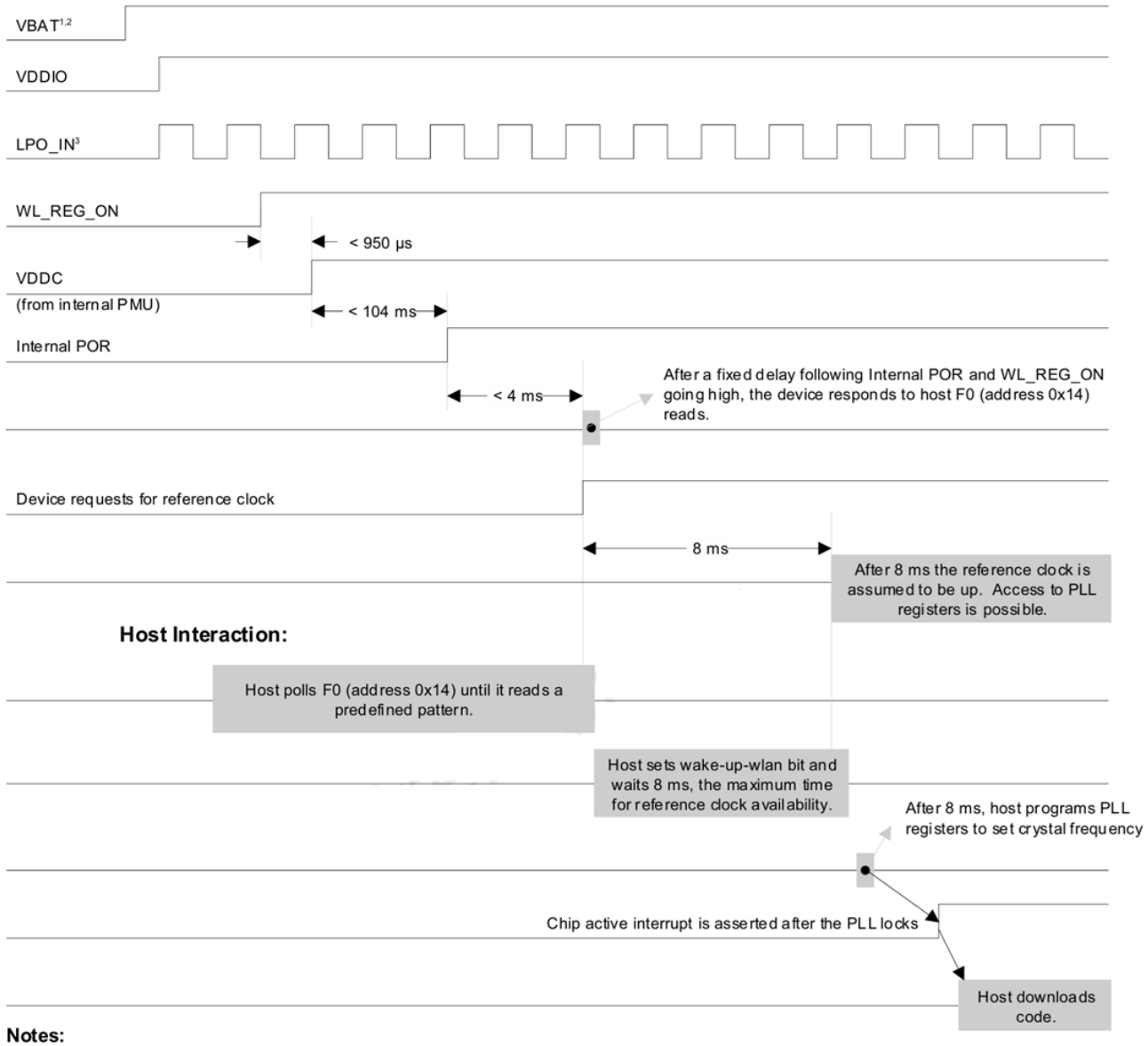
9.2 WL_REG_ON and BT_REG_ON Deassertion Durations



WL_REG_ON and BT_REG_ON Deassertion Durations for Various Reset Scenarios

9.3 Start-Up Sequences

The following figure shows the WLAN subsystem start-up sequence and Startup Sequence—BT Subsystem, shows the Bluetooth subsystem start-up sequence.



Notes:
1. The VBAT and VDDIO 10%–90% rise-time slopes must be greater than 50 microseconds/V.
2. VBAT should be up before or at the same time as VDDIO. VDDIO should not be present first or be held high before VBAT is high.
3. LPO_IN must start on or after VDDIO assertion and before WL_REG_ON assertion.

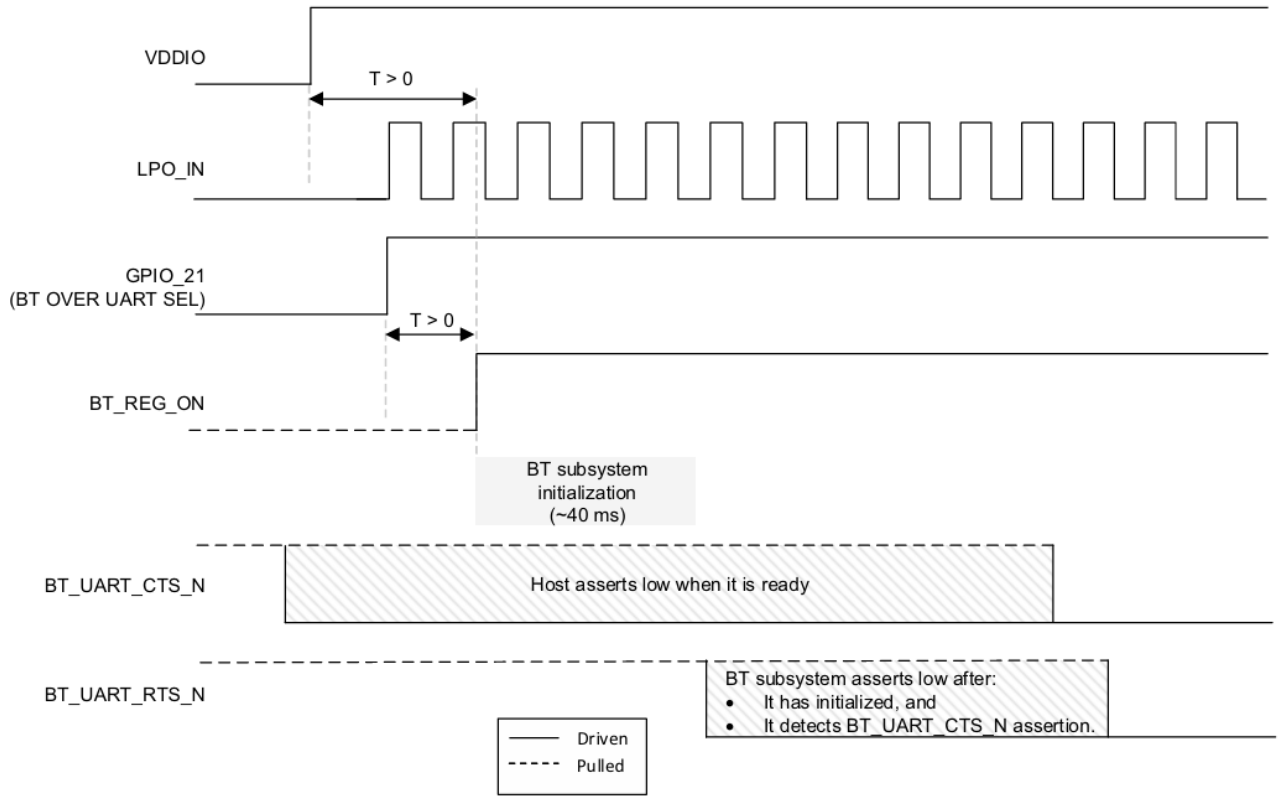
Start-Up Sequence

The following figure shows the BT subsystem startup sequence. The following information applies to the startup sequence:

- The BT_REG_ON low-to-high transition starts BT subsystem initialization. BT_REG_ON will be ignored while VDDIO is low.
- The external LPO clock (LPO_IN), if used, must be present before BT_REG_ON assertion.
- To initiate UART communication, the host must assert BT_UART_CTS_N low, which it can do at any time.
- To enable UART communication, the BT subsystem must assert BT_UART_RTS_N low, which it can't do until after:

– It has completed its initialization, and

– It has detected BT_UART_CTS_N low assertion.



Startup Sequence—BT Subsystem

Note: Regarding Startup Sequence—BT Subsystem Figure:

1.Although not shown, VBAT must be present.

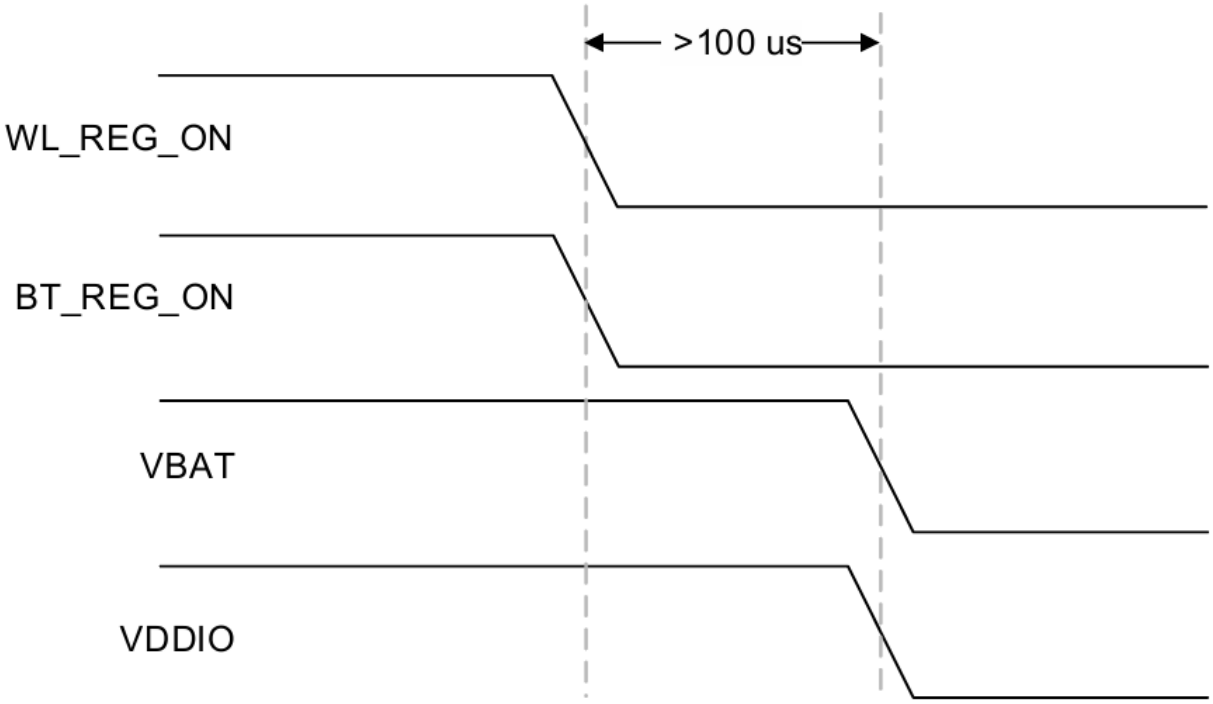
2. The time axis (x-axis) is not to scale.

3. The assertion of BT_REG_ON is dependent on the completion of WLAN firmware initialization

4. If BT_UART_CTS_N is asserted before the BT subsystem finishes its initialization sequence,

then UART communication can begin very shortly after BT subsystem initialization. If BT_UART_CTS_N is asserted after the BT subsystem finishes its initialization sequence, then UART communication can begin within 12.5 ms of BT_UART_CTS_N assertion; that is, the BT subsystem will assert BT_UART_RTS_N within 12.5 ms of BT_UART_CTS_N assertion.

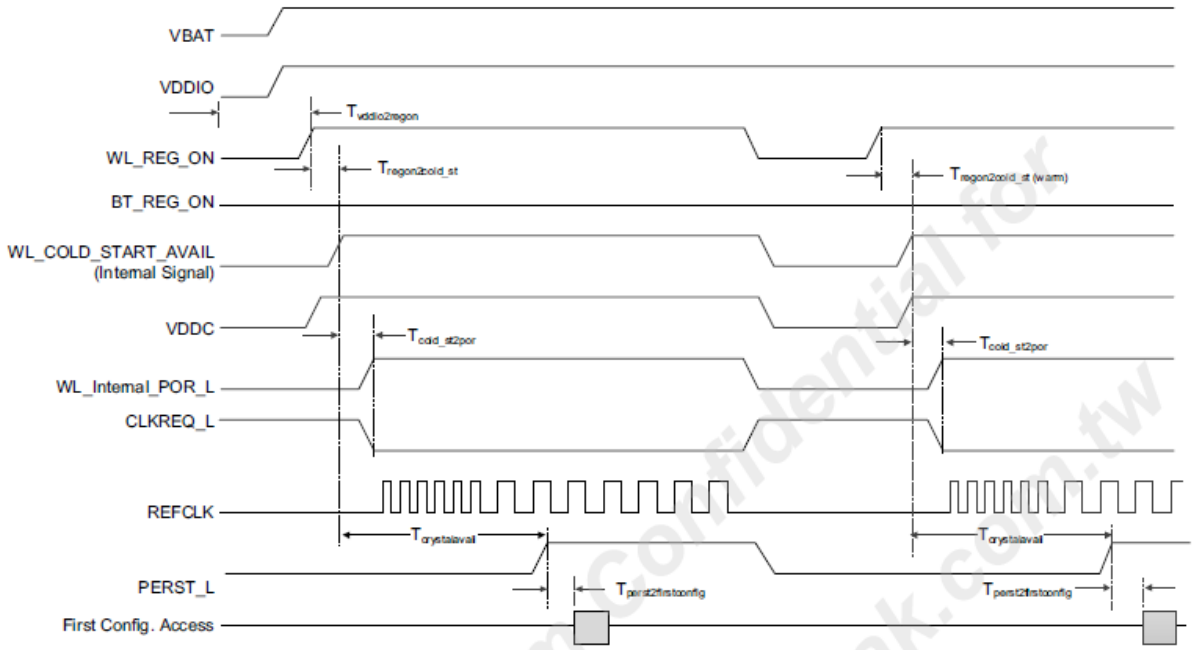
9.4 Power-Down Sequence—Dedicated WLAN PCIe Host and BT UART Host



9.5 PCIe Interface Description

The PCI Express (PCIe) core on the AP6690P is a high-performance serial I/O interconnect that is protocol compliant and electrically compatible with the PCI Express Base Specification v3.0 running at Gen3 speeds.

PCIe Power-On Timing



Timing Parameter	Notes	Value[a]	Unit
$T_{vddio2regon}$	–	0.1	ms
$T_{regon2cold_st}$	3.4 ms + 162 instruction-level parallelism (ILP) cycles	10.13	ms
T_{cold_st2por}	54 ILP cycles	2.24	ms
$T_{crystalavail}$	509 ILP cycles	21.17	ms
$T_{perst2firstconfig}$	–	6.0	ms
$T_{vddioon2firstconfig}$	$T_{vddio2regon} + T_{regon2cold_st} + T_{crystalavail} + T_{perst2firstconfig}$	37.4[b]	ms
$T_{regon2cold_st\ (warm)}$	162 ILP cycles	6.73	ms

a. The time values assume an ILP tolerance of ±30%.

b. With VDDIO as a reference, 37.4 ms is the minimum system wait time before issuing the first configuration access.

9.6 I2S Interface Description

The AP6690P has an I2S digital audio port for Bluetooth audio. The interface supports:

- A maximum 96 kHz audio rate for 32-bit samples (16-bit left-channel and 16-bit right-channel samples).
- Simultaneous transmission and reception.
- Half-duplex operation on a single data pin.
- Clock master and non-master modes.

BT_I2S_CLK and BT_I2S_WS become outputs in master mode and inputs otherwise, whereas BT_I2S_DO is always an output. The channel word length is 16 bits, and the data is justified so that the MSB of the left-channel data is aligned with the MSB of the I2S bus, in accordance with the I2S specification. The MSB of each data word is transmitted one bit clock cycle after the BT_I2S_WS transition, synchronous with the falling edge of the bit clock. Left-channel data is transmitted when BT_I2S_WS is low, and right-channel data is transmitted when BT_I2S_WS is high. Data bits sent by the AP6690P are synchronized with the falling edge of BT_I2S_CLK and should be sampled by the receiver on the rising edge of BT_I2S_CLK.

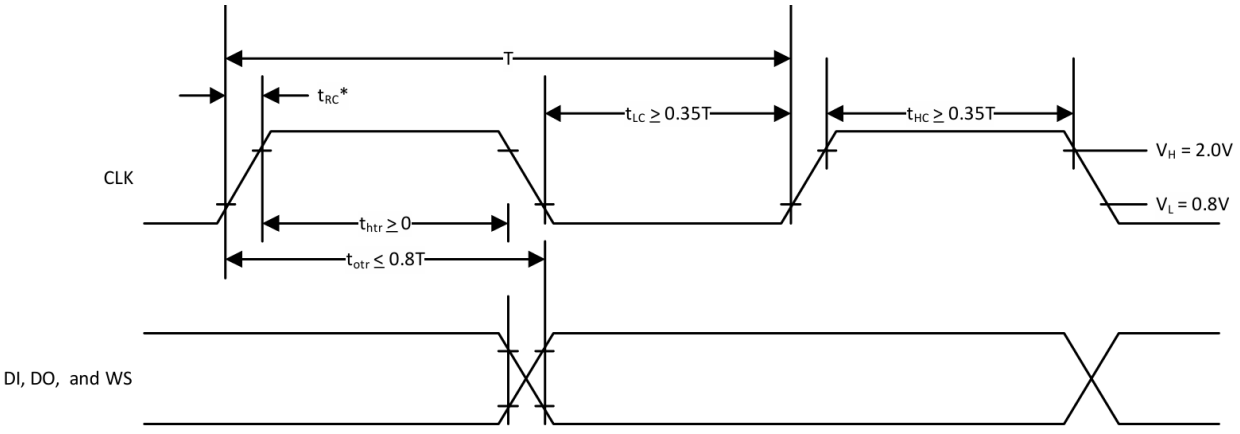
When configured for master clock mode, the master clock is generated from the input reference clock using an N/M clock divider.

	Transmitter				Receiver				Notes
	Lower Limit		Upper Limit		Lower Limit		Upper Limit		
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Clock period T	T_{tr}	—	—	—	T_r	—	—	—	a
Master Mode: Clock Generated by Transmitter or Receiver									
HIGH t_{HC}	$0.35T_{tr}$	—	—	—	$0.35T_{tr}$	—	—	—	b
LOWt_{LC}	$0.35T_{tr}$	—	—	—	$0.35T_{tr}$	—	—	—	b
Non-Master Mode: Clock Accepted by Transmitter or Receiver									
HIGH t_{HC}	—	$0.35T_{tr}$	—	—	—	$0.35T_{tr}$	—	—	c
LOW t_{LC}	—	$0.35T_{tr}$	—	—	—	$0.35T_{tr}$	—	—	c
Rise time t_{RC}	—	—	$0.15T_{tr}$	—	—	—	—	—	d
Transmitter									
Delay t_{dtr}	—	—	—	0.8T	—	—	—	—	e
Hold time t_{htr}	0	—	—	—	—	—	—	—	d
Receiver									
Setup time t_{sr}	—	—	—	—	—	$0.2T_r$	—	—	f
Hold time t_{hr}	—	—	—	—	—	0	—	—	f

a. The system clock period T must be greater than Ttr and Tr because both the transmitter and receiver have to be able to handle the data transfer rate.
b. At all data rates in master mode, the transmitter or receiver generates a clock signal with a fixed mark/space ratio. For this reason, tHC and tLC are specified with respect to T.
c. In non-master mode, the transmitter and receiver need a clock signal with minimum high and low periods so that they can detect the signal. So long as the minimum periods are greater than 0.35Tr, any clock that meets the requirements can be used.
d. Because the delay (tdtr) and the maximum transmitter speed (defined by Ttr) are related, a fast transmitter driven by a slow clock edge can result in tdtr not exceeding tRC which means thtr becomes zero or negative. Therefore, the transmitter has to guarantee that thtr is greater than or equal to zero, so long as the clock rise-time tRC is not more than tRCmax, where tRCmax is not less than 0.15Ttr.
e. To allow data to be clocked out on a falling edge, the delay is specified with respect to the rising edge of the clock signal and T, always giving the receiver sufficient setup time.
f. The data setup and hold time must not be less than the specified receiver setup and hold time.

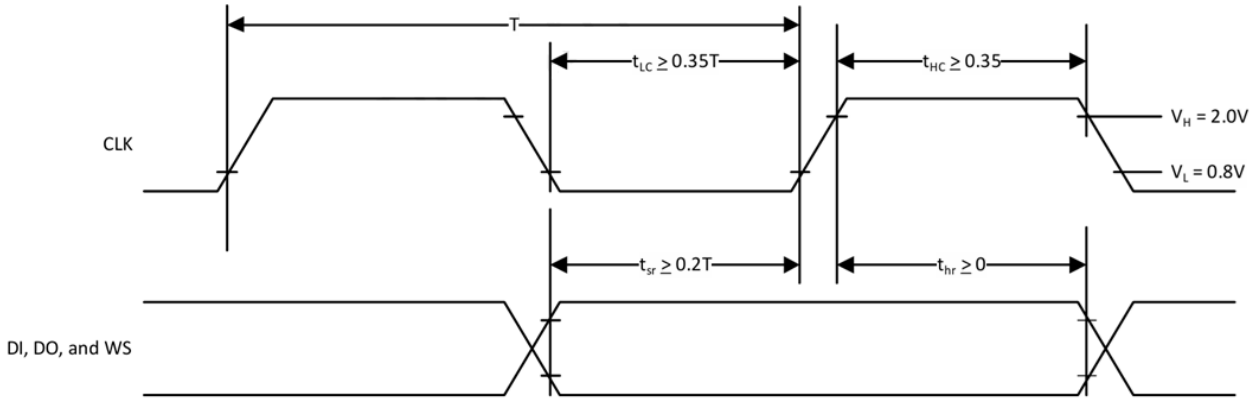
Note: The time periods specified in Figure, I2S Transmitter Timing, and Figure, I2S Receiver Timing, are defined by the transmitter speed. The receiver specifications must match the transmitter performance.

Figure, I2S Transmitter Timing



T = Clock period
T_{tr} = Minimum allowed clock period for transmitter
T = T_{tr}
* t_{RC} is only relevant for transmitters not in master mode.

Figure, I2S Receiver Timing



T = Clock period
T_r = Minimum allowed clock period for transmitter
$T > T_r$

9.7 UART Interface Description

The AP6690P UART host interface is a standard 4-wire interface (RX, TX, RTS, and CTS) with adjustable baud rates from 9600 bps to 4.0 Mbps. The interface features an automatic baud rate detection capability that returns a baud rate selection. Alternatively, the baud rate may be selected through a vendor-specific UART HCI command.

The UART has a 1040-byte receive FIFO and a 1040-byte transmit FIFO to support EDR. Access to the FIFOs is conducted through the AHB interface through either DMA or the CPU. The UART supports the Bluetooth 5.4 UART HCI specification: H4, a custom Extended H4, and H5. The default baud rate is 115.2 K baud.

The UART supports the 3-wire H5 UART transport, as described in the Bluetooth specification (Three wire UART Transport Layer). Compared to H4, the H5 UART transport reduces the number of signal lines required by eliminating the CTS and RTS signals.

The AP6690P UART can perform XON/XOFF flow control and includes hardware support for the Serial Line Input Protocol (SLIP). It can also perform wake-on activity. For example, activity on the RX or CTS inputs can wake the chip from a sleep state.

Normally, the UART baud rate is set by a configuration record downloaded after device reset, or by automatic baud rate detection, and the host does not need to adjust the baud rate. Support for changing the baud rate during normal HCI UART operation is included through a vendor-specific command that allows the host to adjust the contents of the baud rate registers. The AP6690P UARTs operate correctly with the host UART as long as the combined baud rate error of the two devices is within ±2%.

Figure. UART Timing

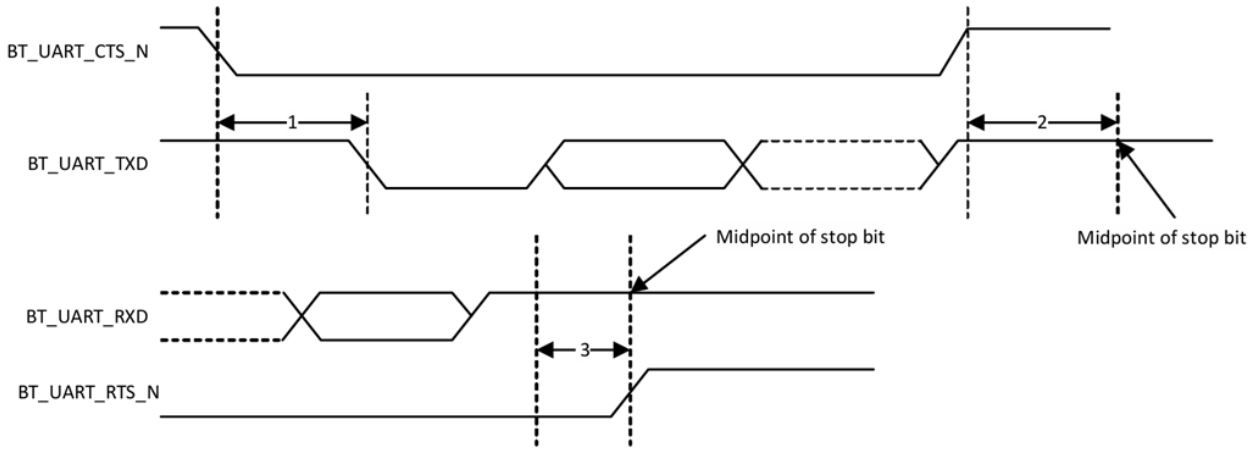
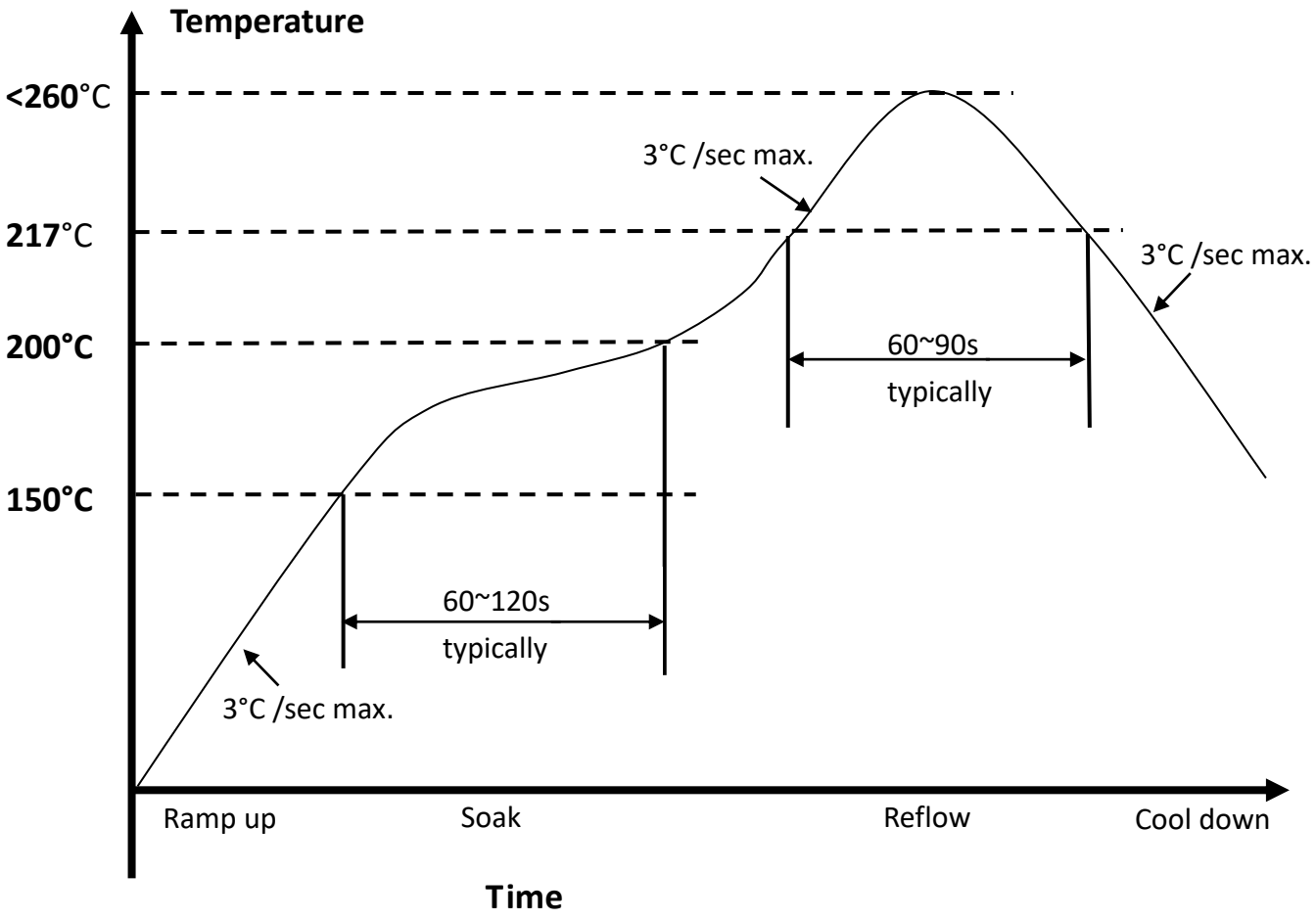


Table UART Timing Specifications

Reference	Characteristics	Minimum	Typical	Maximum	Unit
1	Delay time, BT_UART_CTS_N low to BT_UART_TXD valid	—	—	1.5	Bit periods
2	Setup time, BT_UART_CTS_N high before midpoint of stop bit	—	—	0.5	Bit periods
3	Delay time, midpoint of stop bit to BT_UART_RTS_N high	—	—	0.5	Bit periods

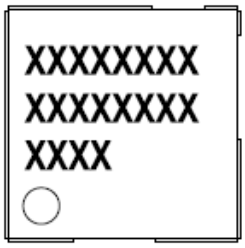
10. Recommended Reflow Profile



1. Referred to IPC/JEDEC standard
2. Peak Temperature : <260°C(Time within 5°C of actual Peak Temperature 20-40 seconds)
3. Cycle of Reflow : 2 times max.
4. Adding Nitrogen (N2) to implement 2000ppm or less of oxygen concentration during reflow process is recommended.
5. If the shelf time is exceeded, be sure baking step to remove the moisture from the component

11. Package Information

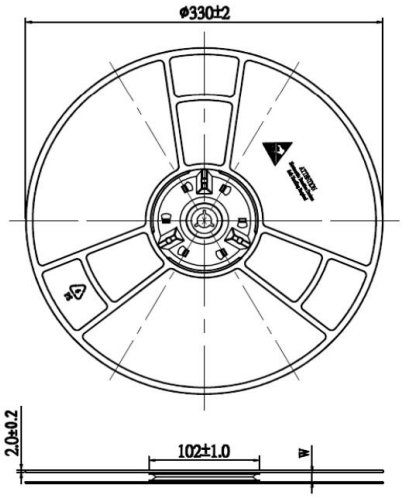
11.1 Marking



Rows	Content	Note
Row 1	XXXXXXXX	Model Name
Row 2	XXXXXXX or XXXXXXXX (8 digitals or 9 digitals)	Lot Code
Row 3	YYWW	Date Code
Row 4	Through hole or non through hole	Pin 1 indicator

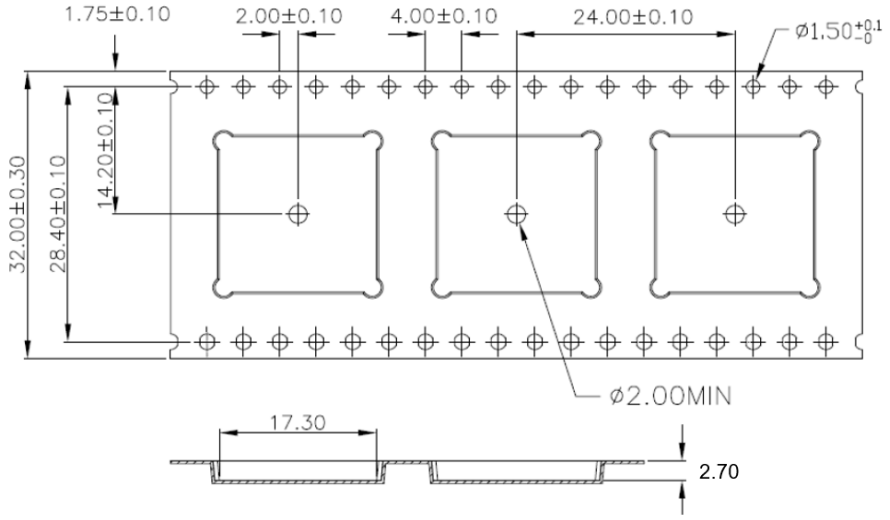
11.2 Tape & Reel Data

Reel



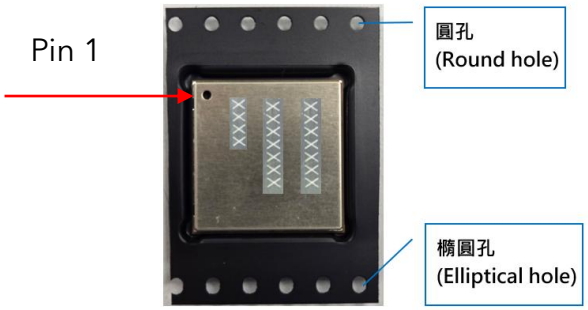
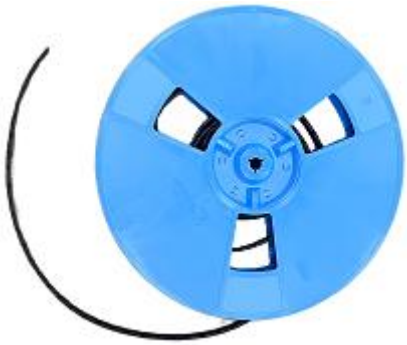
(unit :mm)

Carrier tape (unit :mm)



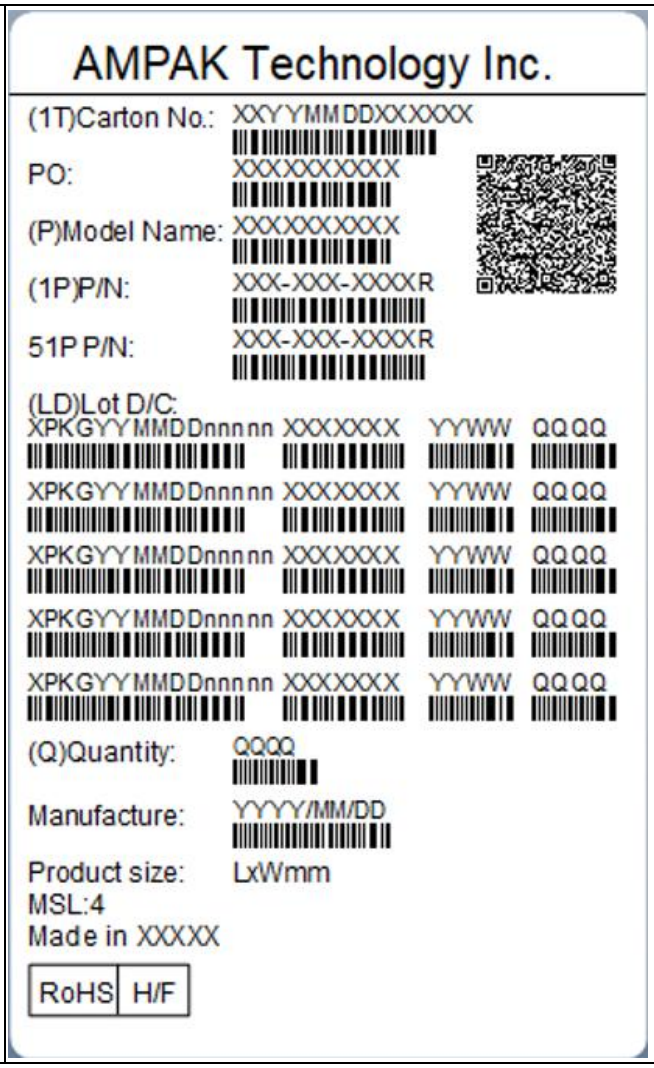
W	32.00±0.30
A0	17.30±0.10
B0	17.30±0.10
K0	2.70±0.10

11.3 Tape & Reel Packing

Items	Photo	Description
1		Pin 1 indicator in carrier tape
2		13" W32.0mm Reel
3		Humidity Indicator Card & Desiccant inside

4		MSL Caution label on top side of Al bag
5		Anti-static and humidity notice on top side of Al bag
6	Caution This bag contains MOISTURE-SENSITIVE DEVICES LEVEL 4 If blank,see adjacent bar code label 1. Calculated shelf life in sealed bag:12months at<40℃and <90% relative humidity(RH) 2. Peak package body temperature:250℃ If blank,see adjacent bar code label 3. After bag is opened,devices that will be subjected to reflow solder or other high temperature process must be a) Mounted within:72hours of factory conditions If blank,see adjacent bar code label ≤30℃/60% RH,or b) Stored per J-STD-033 4. Devices require bake,before mounting,if: a) Humidity Indicator Card reads>10% for level 2a-5a devices or>60% for level 2 devices when read at 23±5℃ b) 3a or 3b are not met. 5.If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure. Bag Seal Date: If blank,see adjacent bar code label Note:Level and body temperature defined by IPC/JEDEC J-STD-020	MSL Level / Storage Condition
7		1 reel per inner box (Box) Quantity: 300pcs/reel

8	(1T)PKG S/N: XPKGYYMMDDnnnnn PO: NA (P)Model Name: XXXXXXXXXX (1P)P/N: XXX-XXX-XXXXR 51P P/N: XXX-XXX-XXXXR (L)Lot Code: XXXXXXXX (D)Date Code: YYWW (Q)Quantity: QQQQ Product size: LxWmm MSL:4 Made in XXXXXX RoHS | H/F	Inner box (Box) label (Reel label/Al Bag label/Box label) The label content includes barcode and QR CODE
9		5 inner boxes per outer box (Carton) Quantity: 1500pcs/outer box (Carton)
10		Outer box (Carton) Quantity: 1500pcs/outer box (Carton)

11		Outer box (Carton) label The label content includes barcode and QR CODE